Preliminary Data Filtering For Linear Optics Correction

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Introduction

- Intention of the data filtering is to Screen out unreliable data from further linear optics corrections.

- The following two filters are built in the application codes Loptics

  - Bpm status bit
  - Drive tune mismatch

- The additional filtering of large chi^2 is considered here.

Fitting Formula

$$x_s(k) = A_m \left\{ \cos(\psi_m) \left[\cos(2\pi Q_x^{ac} k) - r \cos(2\pi Q_x^{ac} k - 2\pi Q_x^{ac} + 2\chi_x^{ac}) \right] \right.$$
$$\left. - \sin(\psi_m) \left[\cos(2\pi Q_x^{ac} k) + r \sin(2\pi Q_x^{ac} k - 2\pi Q_x^{ac} + 2\chi_x^{ac}) \right] \right\}$$
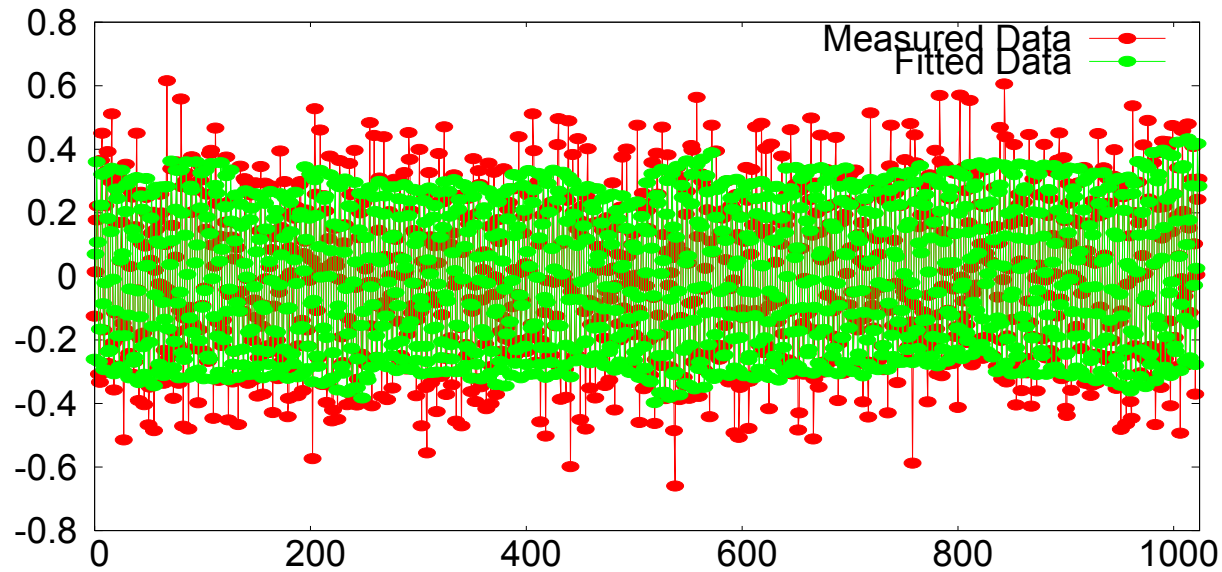
$$r = \frac{\sin(\pi(Q_x^{ac} + Q_x))}{\sin(\pi(Q_x^{ac} - Q_x))}$$

Betatron phase advance
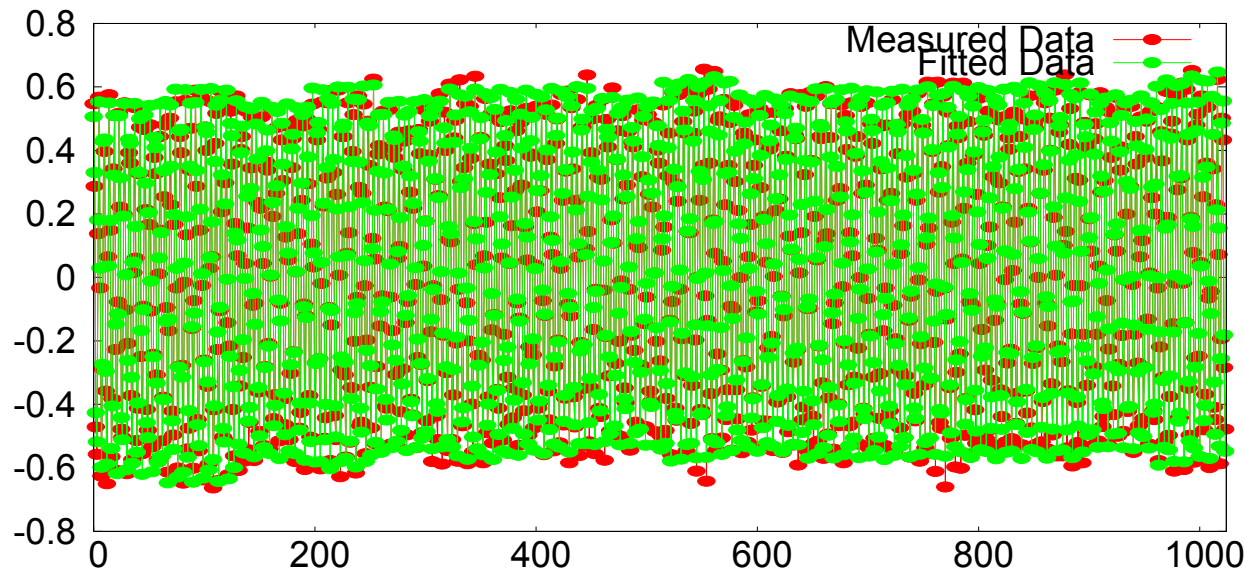
$$\psi_m = -\pi(Q_x^{ac} - Q_x) + \chi_x^{ac} - \Delta\psi_s$$

Initial phase of ac dipole

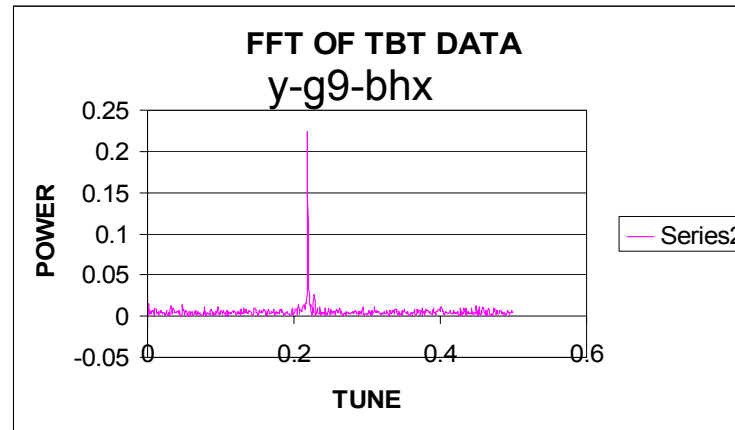# Comparison of the measured data with the fitting data

Poor fitting/noisy bpm data

Reasonable fitting/ quiet bpm data

FFT of The bpm TBT Data

The data is taken at file Hacd_inj_06. y -g9 -bhx produces noisy data which make the fitting chi^2 8 times larger than the average value.

**FFT OF TBT DATA**
y-g9-bhx

A typical FFT data from a quiet bpm, which reasonably agree with sin fitting.

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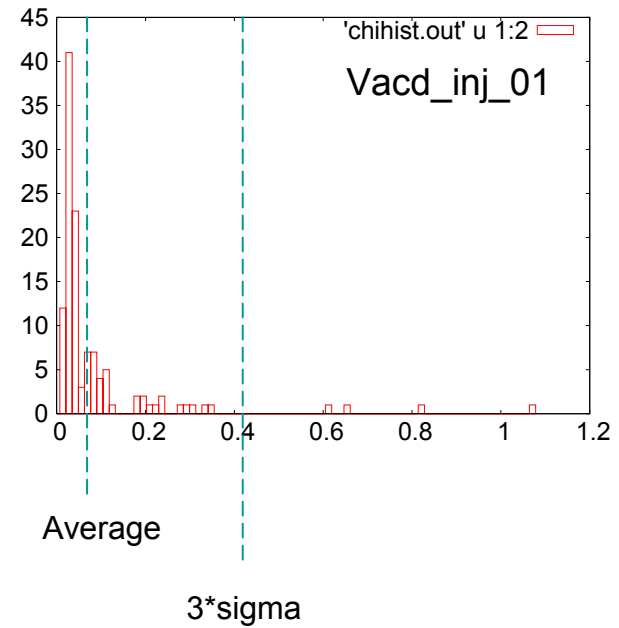
yi10-bh15 **FFT OF TBT DATA**

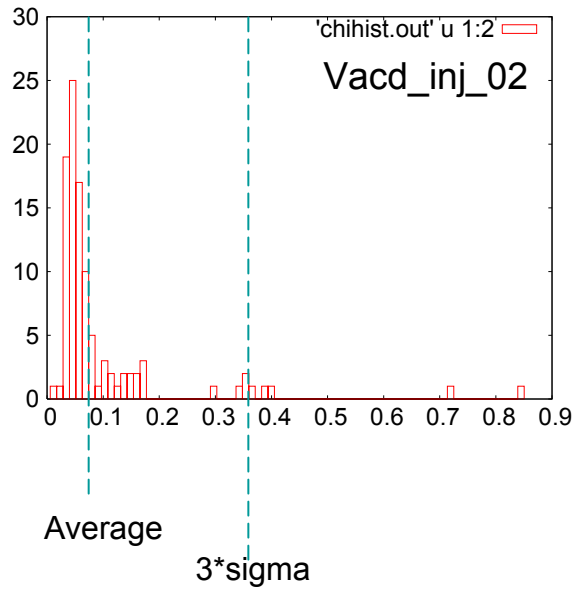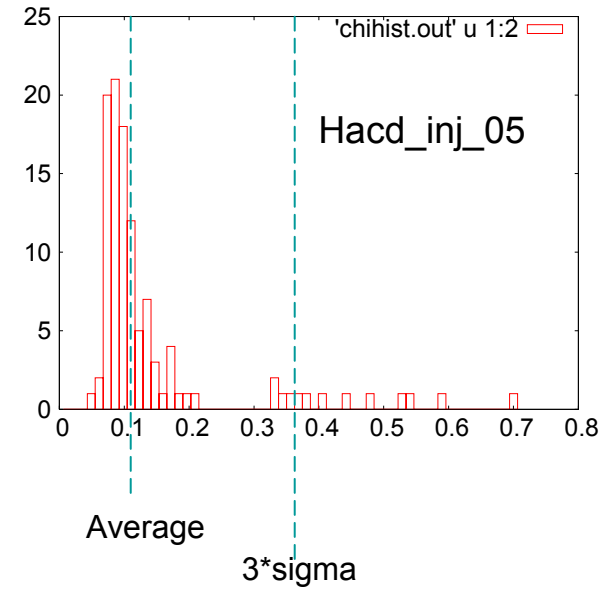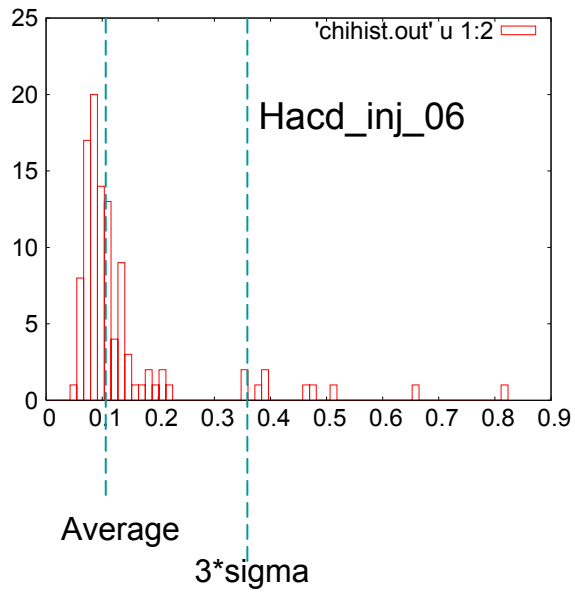### y-g3-bhx **FFT for Wrong Tune Data**
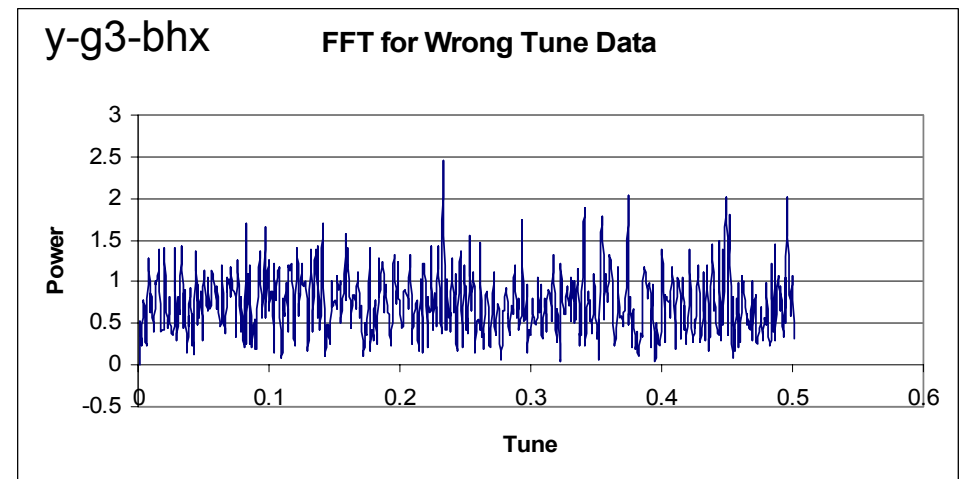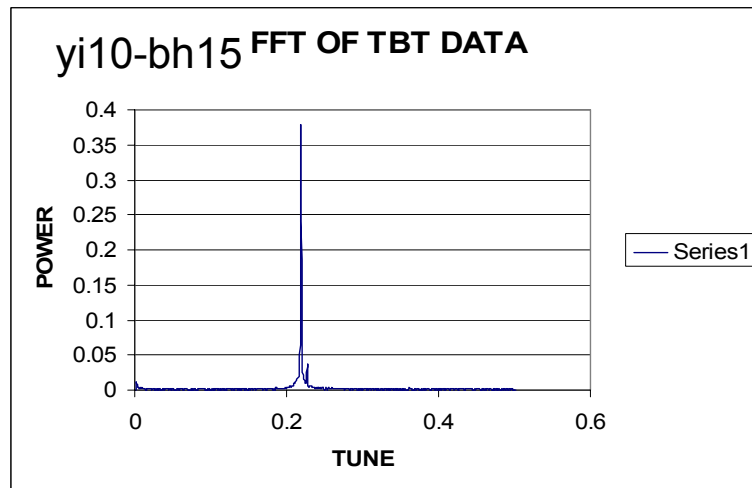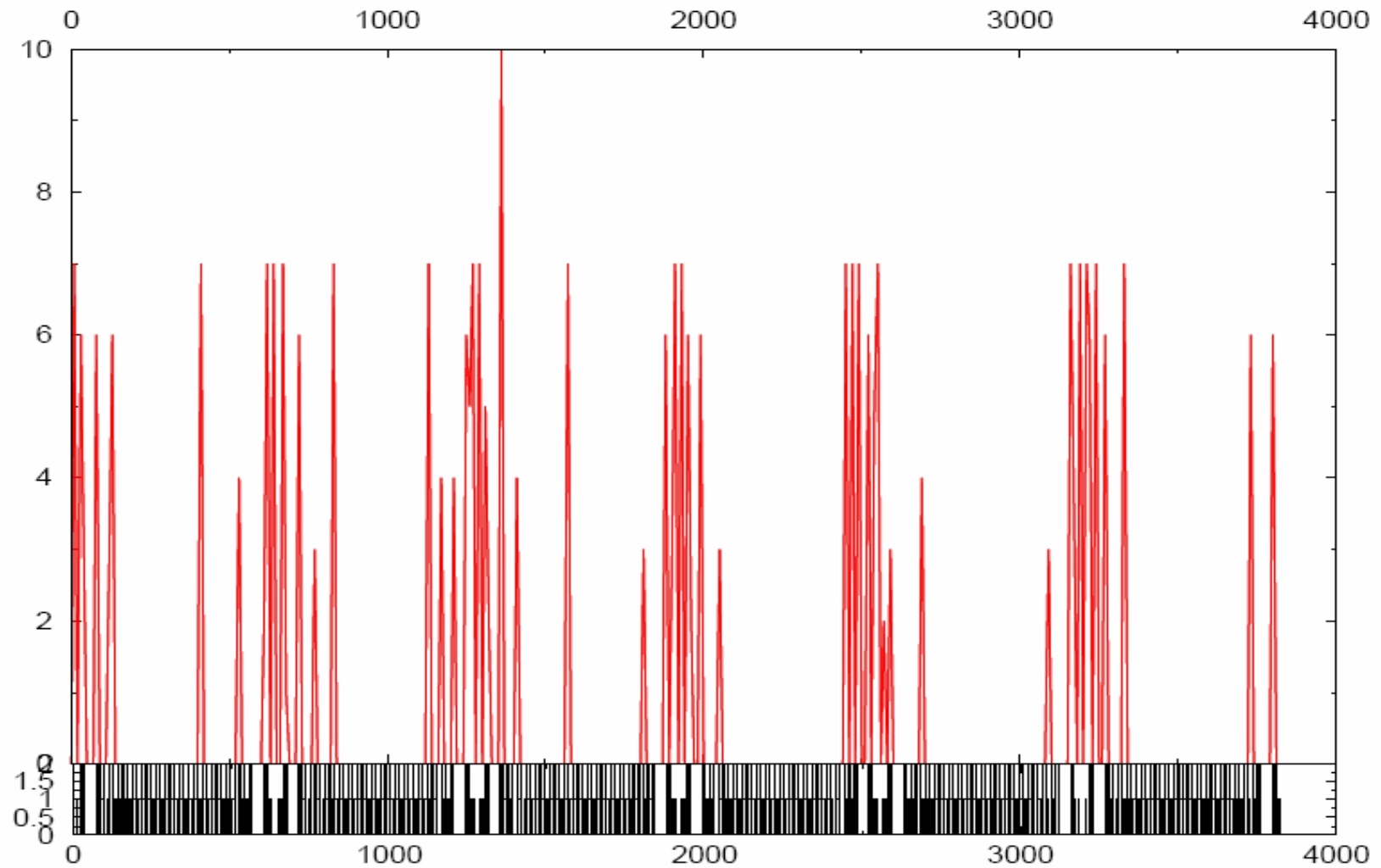
Drive Tune Cut-off

As the beam is adiabatically excited by the AC dipole, the beam should only oscillate at the drive tune of the ac dipole. Consequently, the cut-off for the tune discrepancy is set to 0.5*sigma.
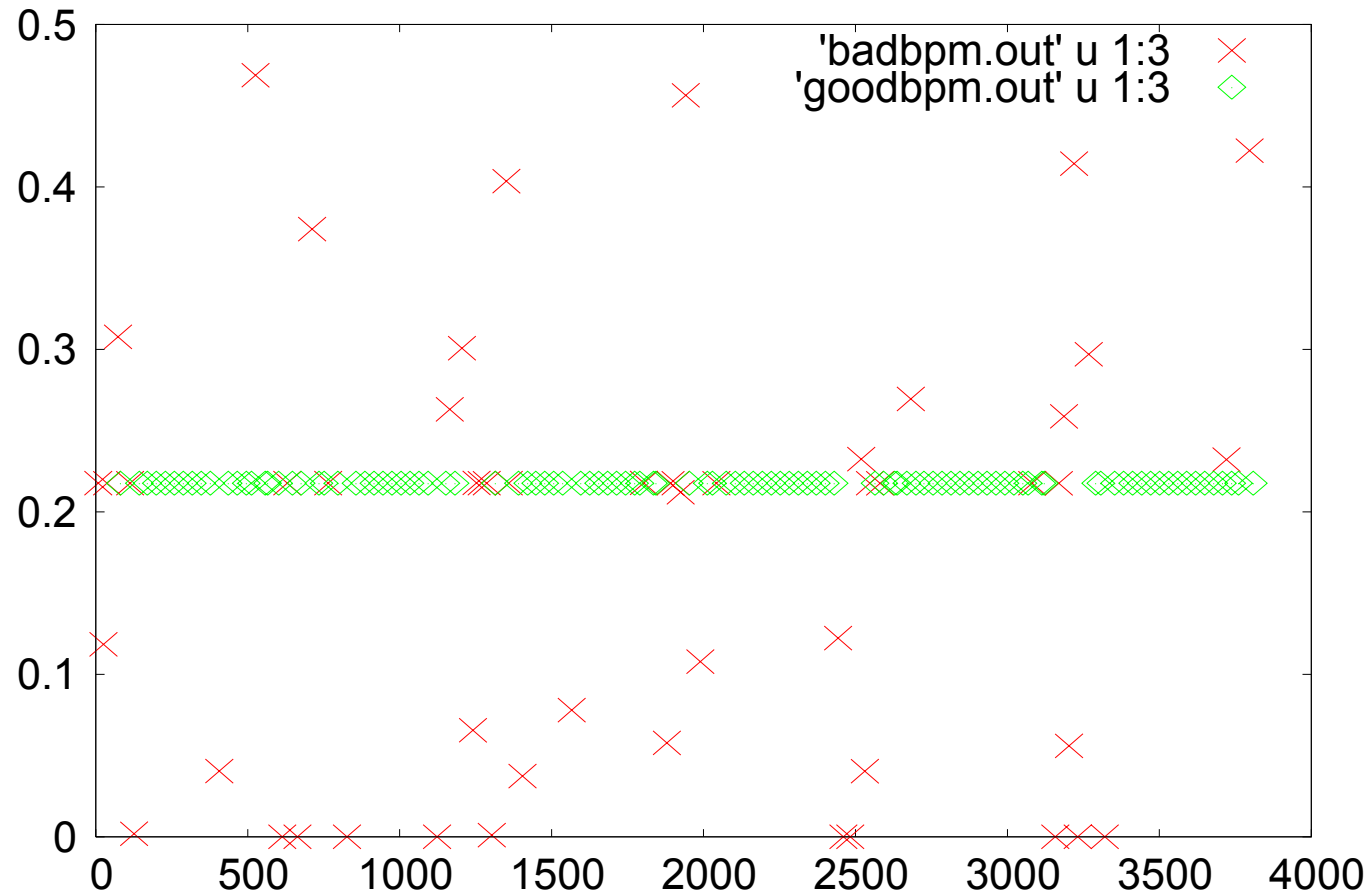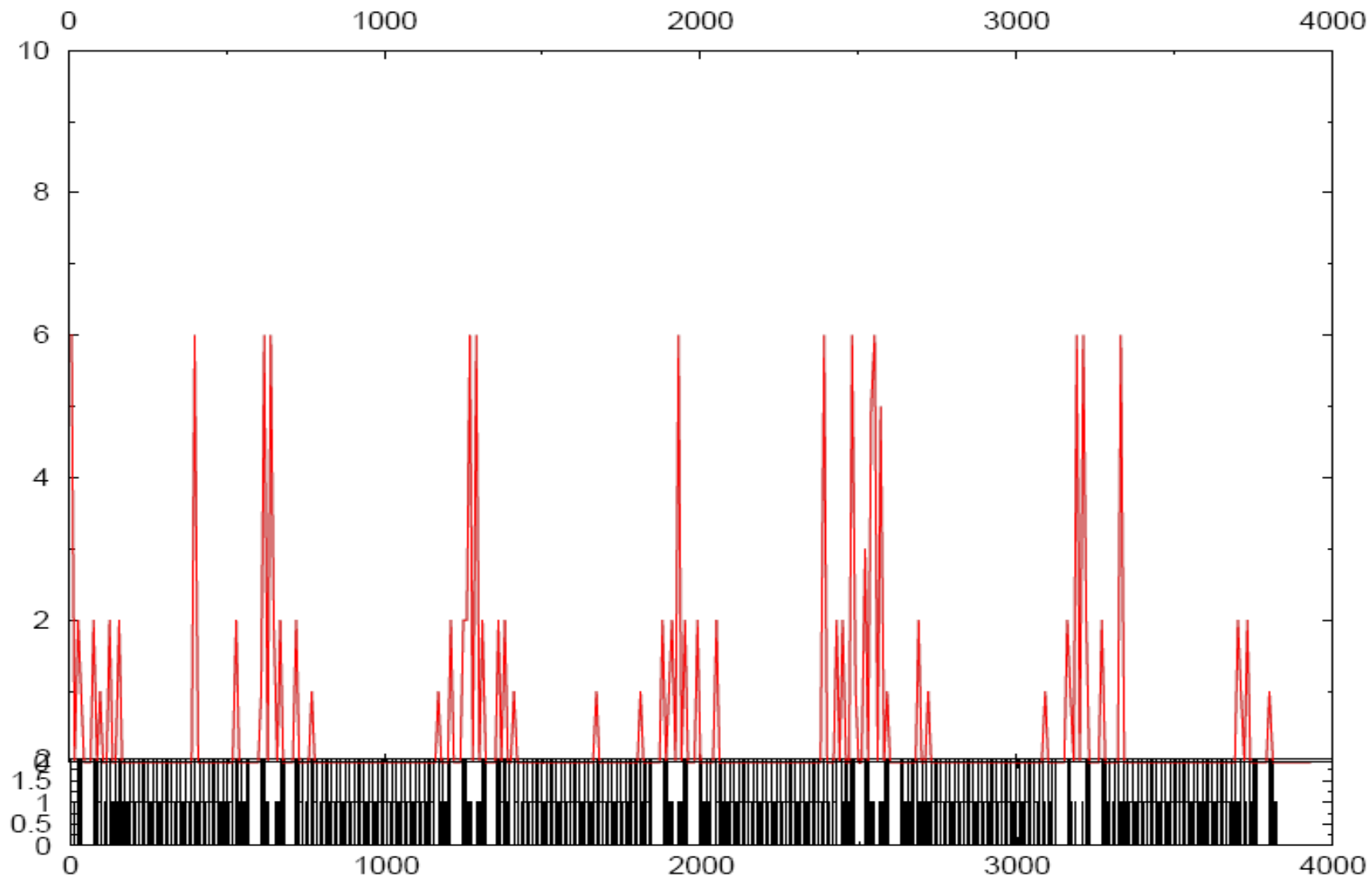
Chi^2 Cut-off

Horizontal bpm fail times through the 7 baseline runs vs bpm location

Vertical bpm fail times through the 6 baseline runs vs bpm location

Summary

- For the Baseline run of the ac dipole experiment (run 09628, Hacd_inj_01~Hacd_inj_07 and Vacd_inj_01~Vacd_inj_06), about 20% of the bpms in the horizontal plane and 10% of the bpms in the vertical plane frequently fails due to the drive tune discrepancy or large chi^2.

- Improvement of the turn by turn data performance is critical for the linear optics correction.